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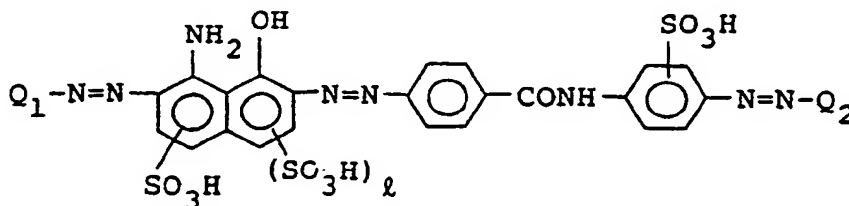
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W-8000 München 80(DE)(54) **Trisazo compounds and use thereof.**

(57) A trisazo compound represented by the following formula in the free acid form:

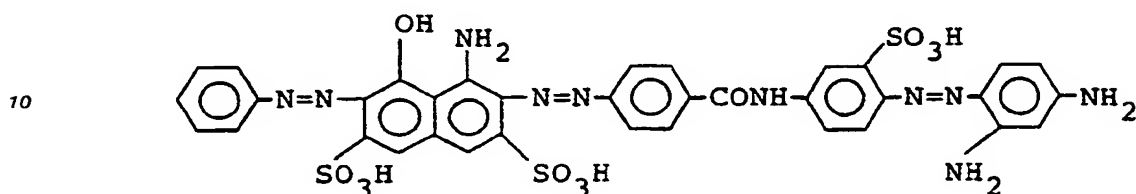


wherein Q₁ and Q₂ independently of one another are each unsubstituted or substituted phenyl or naphthyl group and l represents 0 or 1, which is useful for dyeing fiber, paper, leather and the like having hydroxy or amido group in black color, and for use in an ink used in ink jet printing and the like.

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The present invention relates to trisazo compounds. More particularly, the present invention relates to trisazo compounds useful for dyeing or printing fiber, paper, leather and the like having hydroxy or amido groups, in black color, and for use in an ink used in ink jet printing and the like.

In JP-A- 61-51064, dyes represented by, for example, the following formula are disclosed:



15

Polyazo direct or acid dye prepared using benzidine or its derivative have been used for dyeing or printing a fiber having hydroxyl or amido group, or a composition comprising said fiber. However, in many countries, production of benzidine is now prohibited, and benzidine derivatives such as o-tolidine and dianisidine are registered as special chemical substances of which handling is restricted in production and use, because of their toxicity.

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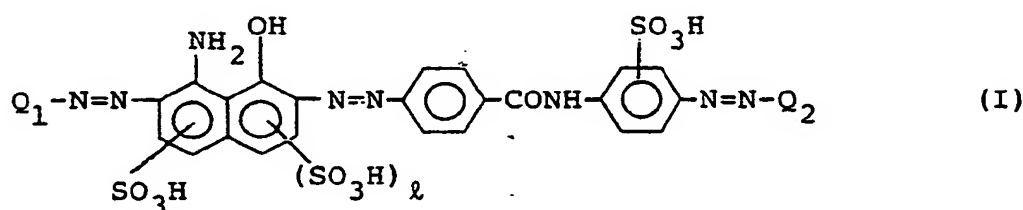
For such a reason, a variety of compounds have been proposed as non-benzidine type dyes. However, they do not reach a level capable of satisfying the requirements of users at the present stage, particularly in the dye abilities. Thus, it is earnestly desired to provide a further improved compound.

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It is the object of the present invention to provide novel compounds capable of fulfilling the necessary conditions of a dye, without using benzidine nor benzidine derivatives.

The present invention provides trisazo compounds represented by the following formula (I) in the free acid form:

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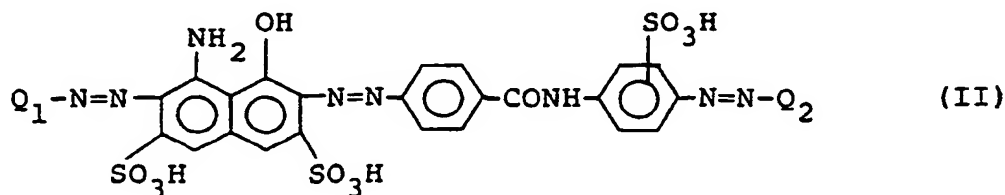
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wherein Q_1 and Q_2 independently of one another are each an unsubstituted or substituted phenyl or naphthyl group and t represents 0 or 1.

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Among the trisazo compounds of the present invention represented by the formula (I), the trisazo compounds represented by the following formulas (II) and (III) in the free acid form are preferred:

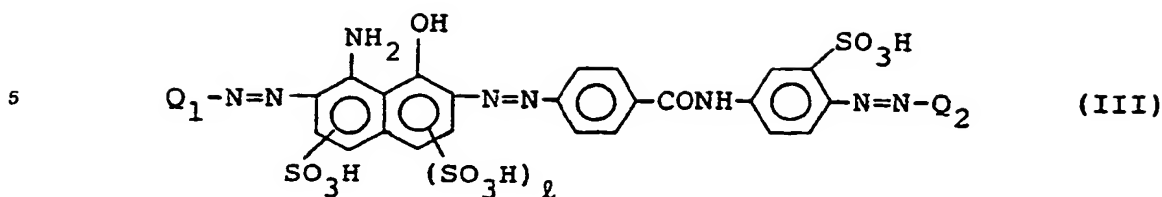
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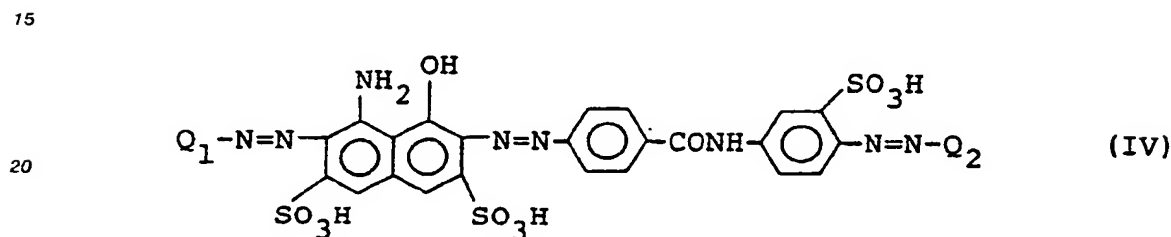
wherein Q_1 and Q_2 are as defined above,

55



10 wherein l , Q_1 and Q_2 are as defined above.

Among these trisazo compounds, the trisazo compounds represented by the following general formula (IV) in the free acid form are particularly preferred:



25 wherein Q_1 and Q_2 are as defined above.

The unsubstituted or substituted phenyl group represented by Q_1 is preferably represented by the following formula:



wherein R_1 and R_2 independently of one another are hydrogen, a nitro, sulfo, sulfamoyl, alkyl, alkoxy, substituted or unsubstituted amino, carboxy or halogeno group, and particularly preferably a phenyl group unsubstituted or substituted by a nitro, sulfo, sulfamoyl, methyl, ethyl, methoxy, ethoxy, carboxy or chloro group.

40

The unsubstituted or substituted naphthyl group represented by Q_1 is preferably represented by the following formula:



wherein R_3 , R_4 and R_5 independently of one another are each hydrogen, a hydroxy or sulfo group.

The unsubstituted or substituted phenyl group represented by Q_2 is preferably a phenyl group substituted once or twice by a substituted or unsubstituted amino group and unsubstituted or substituted by a hydroxy, sulfo, alkyl, alkoxy or carboxy group, or a phenyl group substituted once, twice or three times by a hydroxy group and unsubstituted or substituted by a substituted or unsubstituted amino, sulfo, alkyl, alkoxy or carboxy group. As examples of the substituted amino group, amino groups substituted by methyl, ethyl, hydroxyethyl, cyanoethyl, acetyl or carbamoyl groups can be referred to.

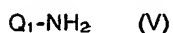
The unsubstituted or substituted naphthyl group represented by Q_2 is preferably a naphthyl group substituted once or twice by a hydroxy group and unsubstituted or substituted by a sulfo, unsubstituted amino, acetyl, phenyl, sulfophenyl, disulfophenyl, benzoyl or methyl-substituted amino group, or a naphthyl group substituted once or twice by an unsubstituted amino group or a methyl-, ethyl-, hydroxyethyl-, cyanoethyl-, acetyl- or carbamoyl-substituted amino group(s) and unsubstituted or substituted by a hydroxy or sulfo group.

As used herein the terms "alkyl" and "alkoxy" refer to residues having 1 to 6, preferably 1 to 4 carbon atoms. Specific examples are the methyl, ethyl, methoxy and ethoxy group.

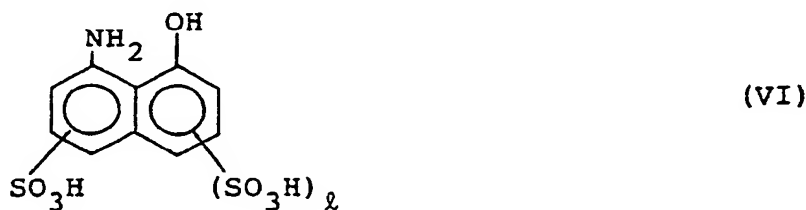
The compound of the present invention is used in the form of the free acid or preferably in the form of an alkali metal salt, ammonium salt or organic amine salt. For example, it is used in the form of the lithium salt, sodium salt, potassium salt, monoethanolamine salt, diethanolamine salt or triethanolamine salt.

Such trisazo compounds represented by the formula (I) can be produced, for example, in the following manner.

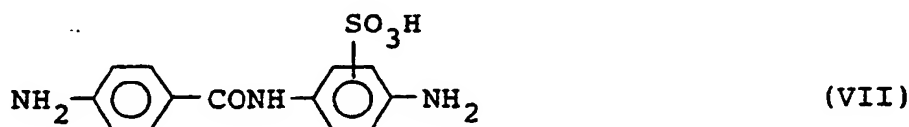
A compound represented by the following formula (V):



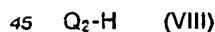
wherein Q_1 is as defined above, is diazotized in a conventional manner followed by coupling with a compound represented by the following formula (VI) in the free acid form:



30 wherein l is as defined above, in an aqueous medium under acidic conditions and then the product of the coupling reaction is further coupled in an acidic or weakly alkaline aqueous medium with a tetrazo compound prepared by tetrazotizing in a conventional manner a compound represented by the following formula (VII):



40 and the disazo-diazo compound thus obtained is coupled with a compound represented by the following formula (VIII):



wherein Q_2 is as defined above, to form a trisazo compound represented by the formula (I).

50 Examples of the compound represented by the formula (V) include 1-aminobenzene, 1-amino-2, 3- or 4-nitrobenzene, 1-amino-2, 3- or 4-benzenesulfonic acid, 5-aminobenzene-1,3-disulfonic acid, 6-aminobenzene-1,4-disulfonic acid, 4-aminobenzene-1,2-disulfonic acid, 1-amino-2, 3- or 4-sulfamoylbenzene, 1-amino-2, 3- or 4-benzoic acid, 1-amino-2, 3- or 4-chlorobenzene, 1-amino-2,5-dichlorobenzene, 1-amino-2, 3- or 4-bromobenzene, 1-amino-2, 3- or 4-methylbenzene, 1-amino-2, 3- or 4-ethylbenzene, 1-amino-2, 3- or 4-methoxybenzene, 1-amino-2, 3- or 4-ethoxybenzene, 1,4-diaminobenzene-2-sulfonic acid, 4-di(β -hydroxyethyl)-1-aminobenzene, 1-aminonaphthalene-4-, 5-, 6-, 7- or 8-sulfonic acid, 2-aminonaphthalene-1-, 8-, 7-, 6- or 5-sulfonic acid, 1-aminonaphthalene-4,7-, 4,6-, 3,7-, 3,8- or 3,6-disulfonic acid, 2-aminonaphthalene-4,8-, 6,8-, 3,6-, 1,5- or 5,7-disulfonic acid, 1-aminonaphthalene-3,6,8-trisulfonic acid and 2-aminonaphthalene-3,6,8- or 4,6,8-trisulfonic acid.

Examples of the compound represented by the formula (VI) include 1-amino-8-naphthol-4-sulfonic acid

and 1-amino-8-naphthol-3,6- or 4,6-disulfonic acid,

among which 1-amino-8-naphthol-3,6-disulfonic acid is particularly preferable.

Examples of the compound represented by the formula (VII) include 4,4'-diaminobenzanilide-3'-sulfonic acid and 4,4'-diaminobenzanilide-2'-sulfonic acid. Among them, 4,4'-diaminobenzanilide-3'-sulfonic acid is particularly preferable.

Examples of the compound represented by the formula (VIII) include aniline derivatives, phenol derivatives, aminophenol derivatives, naphthol derivatives, naphthylaminesulfonic acid derivatives and naphtholsulfonic acid derivatives. Among them, 1-hydroxybenzene, 1-hydroxy-2-, 3- or 4-methyl-benzene, 1,3-dihydroxybenzene, 1-hydroxy-3-methoxybenzene, 1-hydroxy-3-aminobenzene, 3-di(β -hydroxyethyl)-amino-1-hydroxybenzene, 1-di(β -hydroxyethyl)aminobenzene, 1,3-diamino-4-methylbenzene, 1-hydroxy-2-benzoic acid, 1,3-diaminobenzene-6-sulfonic acid, 1-acetylamino-4-methoxy-3-di(β -hydroxyethyl)aminobenzene, 3-diethylamino-1-hydroxybenzene, 1-hydroxynaphthalene, 1-hydroxynaphthalene-4-, 5- or 3-sulfonic acid, 1-hydroxynaphthalene-3,8- or 3,6-disulfonic acid, 1-hydroxynaphthalene-3,6,8-trisulfonic acid, 2-hydroxynaphthalene, 2-hydroxynaphthalene-8-, 7- or 6-sulfonic acid, 2-hydroxynaphthalene-6,8- or 3,6-disulfonic acid, 2-amino-, methylamino-, ethylamino-, acetylamino-, propionylamino-, benzoylamino-, carbamoylamino-, sulfamoylamino or phenylamino-8-hydroxynaphthalene-6-sulfonic acid, 3-amino-, methylamino-, ethylamino-, propionylamino-, acetylamino-, benzoylamino-, carbamoylamino-, sulfamoylamino- or phenylamino-8-hydroxynaphthalene-6-sulfonic acid, 1-amino- or acetylamino-8-hydroxynaphthalene-3,6-disulfonic acid, 1-amino- or acetylamino-8-hydroxynaphthalene-4,6-disulfonic acid, 1-amino-8-hydroxynaphthalene-2,4-disulfonic acid and 1,8-dihydroxynaphthalene-3,6-disulfonic acid are preferred.

The trisazo compound of the present invention is usable either singly or in the form of a mixture, and useful particularly for dyeing cellulose fibers such as rayon, cotton, paper, leather, silk and synthetic polyamide. The dyeing can be carried out by various dyeing processes and printing processes such as the exhaustion dyeing process.

In such dyeing processes, the compounds of the present invention exhibit excellent performances and are usually useful as a black-colored dye. Particularly they have a good solubility ability and a high fixation property and can give a deep black colored dyed product. Further, they are characterized by their good build-up property and the ability to give a dyed product of excellent fastness.

Further, the compounds of the present invention can be made into a stable liquid composition. The liquid composition is particularly suitable for dyeing rayon and paper. Further, the liquid composition is successfully usable as an ink which can be applied, for example, by the ink jet process.

The compounds of the present invention are particularly excellent in solubility. Thus, the ink prepared therefrom has a good storage stability which has so far been an important problem in the field of inks for use in ink jet process. Further, the ink is characterized in that it is free from the problem of clogging of nozzle caused by deposited matter and it can form a deep black-colored image excellent in ink characteristics such as clarity, water resistance and light resistance.

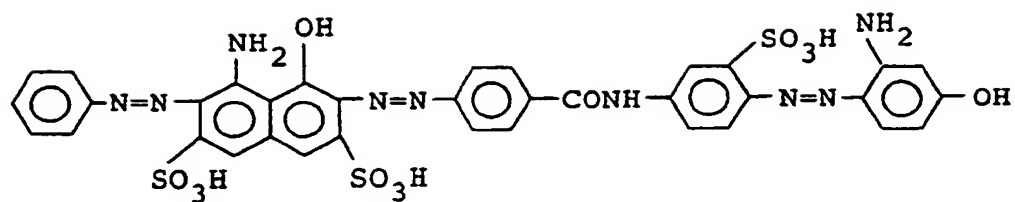
The present invention will be illustrated in more detail by way of the following examples. In the examples, parts are by weight.

Example 1

Aniline (9.3 parts) was diazotized in a conventional manner and coupled with 31.9 parts of 1-amino-8-naphthol-3,6-disulfonic acid at 0-5°C under an acidic condition. Then, a tetrazo compound prepared by tetrazotizing 30.7 parts of 4,4'-diaminobenzanilide-3'-sulfonic acid in a conventional manner was poured thereinto and coupled at 0-10°C under a neutral condition. Then, 10.9 parts of 1-hydroxy-3-aminobenzene was added and the reaction was completed, after which the product was salted out and isolated in a conventional manner to obtain a trisazo compound represented by the following formula in the free acid form:

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(λ_{max} = 605 nm in aqueous medium)

Example 2

15 Example 1 was repeated, except that the 1-hydroxy-3-aminobenzene used in Example 1 was replaced with the compounds of the formula (VIII) as shown in the second column of the following table. Thus, the corresponding trisazo compounds were obtained. In the table, λ_{max} denotes the values measured in an aqueous medium.

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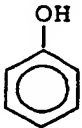
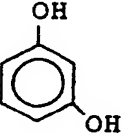
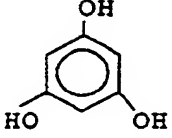
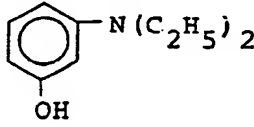
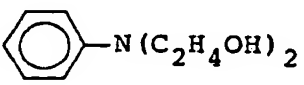
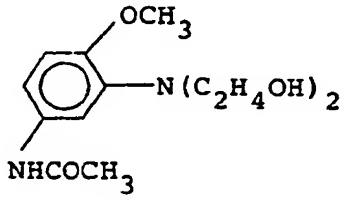
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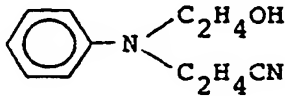
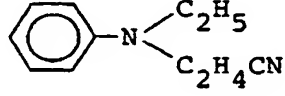
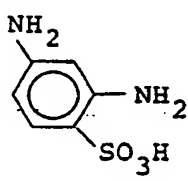
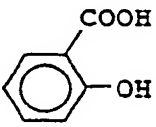
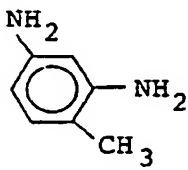
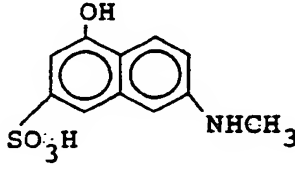
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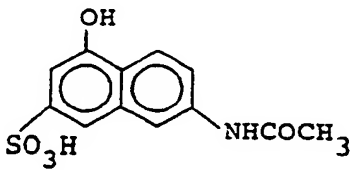
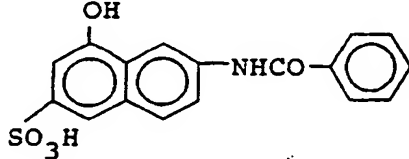
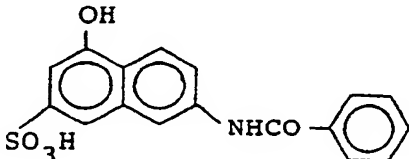
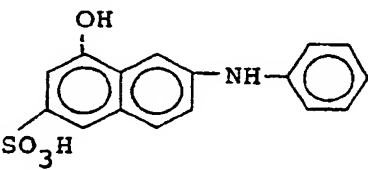
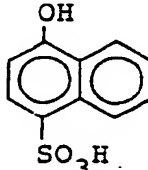
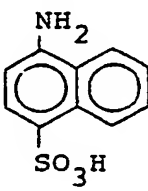
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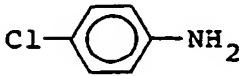
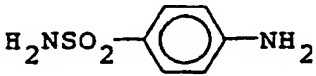
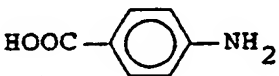
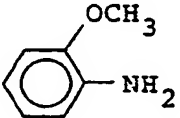
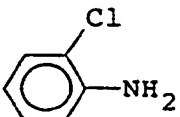
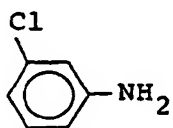
No.	Compound of formula (VIII)	λ_{\max} (nm)
1		600
2		610
3		590
4		500
5		570
6		550

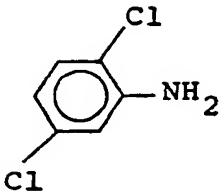
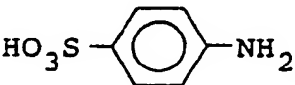
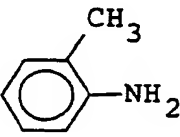
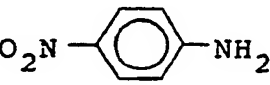
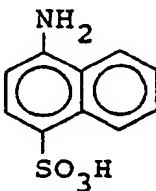
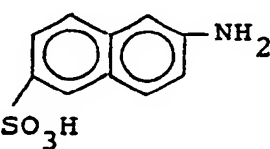
No.	Compound of formula (VIII)	λ_{\max} (nm)
7		565
8		570
9		600
10		600
11		600
12		600

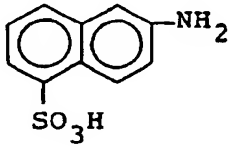
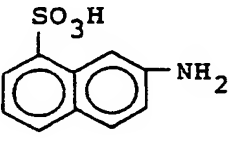
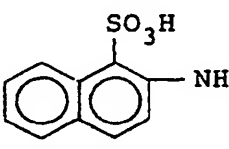
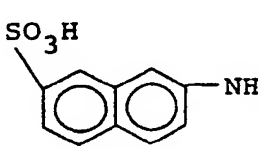
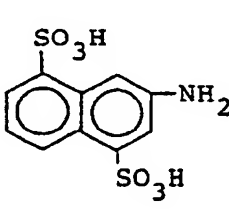
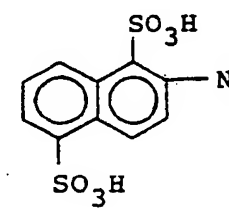
No.	Compound of formula (VIII)	λ_{\max} (nm)
13		600
14		595
15		630
16		600
17		600
18		595

Example 3

Example 1 was repeated, except that the aniline used in Example 1 was replaced with the compounds of formula (V) as shown in the second column of the following table. Thus, the corresponding trisazo compounds were obtained. In the table, λ_{\max} denotes the values measured in an aqueous medium.

No.	Compound of formula (V)	λ_{max} (nm)
19		605
20		625
21		610
22		600
23		615
24		620

No.	Compound of formula (V)	λ_{max} (nm)
25		630
26		600
27		600
28		620
29		620
30		615

No.	Compound of formula (V)	λ_{\max} (nm)
31		615
32		615
33		610
34		615
35		615
36		610

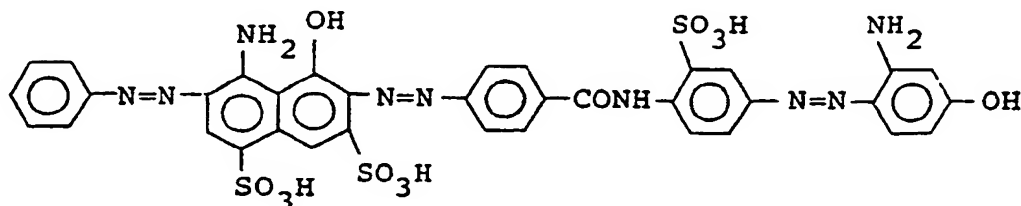
Example 4

Example 1 can be repeated, except that the aniline and 1-hydroxy-3-aminobenzene used in Example 1 are replaced with the compounds of formula (V) used in Example 3 and the compounds of formula (VIII) used in Example 2, respectively, to obtain the corresponding trisazo compounds.

Example 5

Example 1 was repeated, except that the 1-amino-8-naphthol-3,6-disulfonic acid and 4,4'-

diaminobenzanilide-3'-sulfonic acid used in Example 1 were replaced with 1-amino-8-naphthol-4,6-disulfonic acid and 4,4'-diaminobenzanilide-2'-sulfonic acid, respectively. Thus, trisazo compound represented by the following formula in the free acid form was obtained:



(λ_{max} = 610 nm, in aqueous medium)

Example 6

A dyeing bath was prepared by dissolving 0.25 part of the trisazo compound obtained in Example 1 into 200 parts of water. In the dyeing bath was dipped 5.0 parts of viscose rayon staple fiber yarn. After maintaining the bath at 90° C for 10 minutes, 0.25 part of anhydrous sodium sulfate was added, and dyeing was carried out at that temperature for 40 minutes. Then, the yarn was washed with water and dried. The dyed product thus obtained had a black color tone and an excellent fastness.

Example 7

Into 500 parts of an LBKP 20 g/liter pulp dispersion having been beaten up to a degree of beating of CF 400 ml was introduced 0.5 part of the trisazo compound obtained in Example 3 (No. 19). After agitating the mixture for 10 minutes, 0.3 part of Sizepine E (sizing agent manufactured by Arakawa Chemical Industry, Co.). After an additional 10 minutes had passed, 0.3 part of crystalline aluminum sulfate was added, and agitation was continued for 20 minutes to carry out dyeing. Then, the pulp was made into paper and dried. The paper thus prepared had a black color tone and an excellent fastness.

Example 8

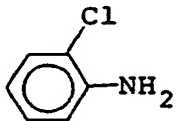
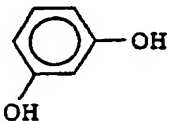
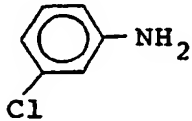
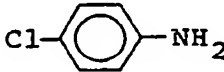
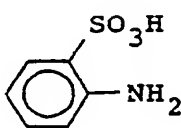
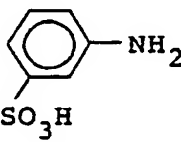

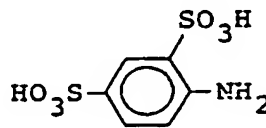
A composition of the following formulation was heated at about 50° C with agitation to form a uniform solution and then filtered through a Teflon filter having a pore diameter of 0.45 μm to prepare an ink.

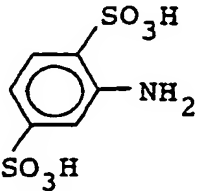
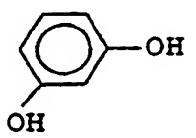
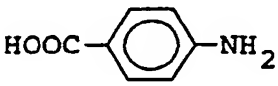
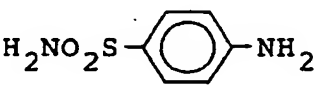
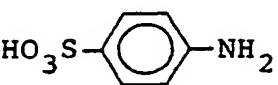
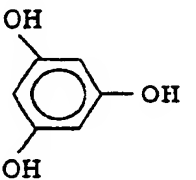
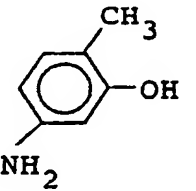
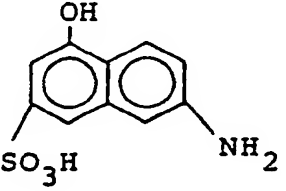
Trisazo compound obtained in Example 1	5 parts
Deionized water	75 parts
Diethylene glycol	25 parts
Dehydroacetic acid sodium salt	0.05 part

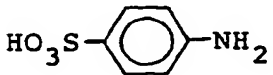
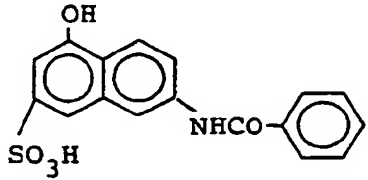
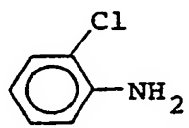
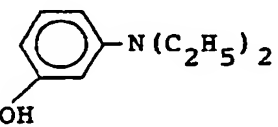
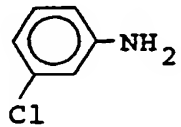
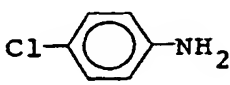
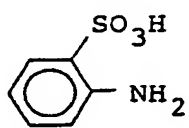
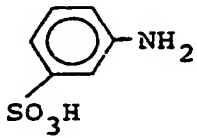
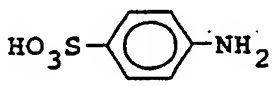
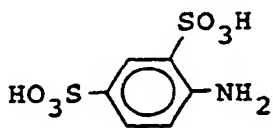
Using the ink thus obtained, an ink jet recording was carried out on a commercially available high quality paper by means of a recording apparatus equipped with an On-Demand type recording head discharging an ink by the action of a piezoelectric vibrator. The image thus formed was excellent in water resistance, light resistance, color depth and clarity.

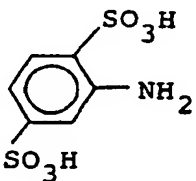
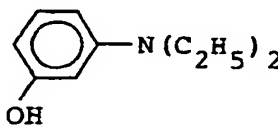
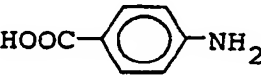
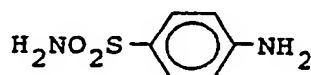

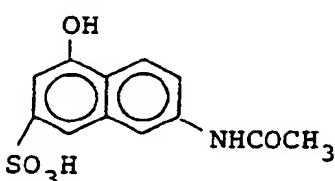
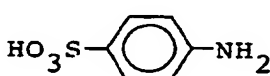
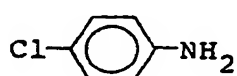
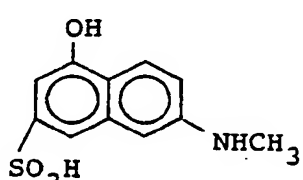
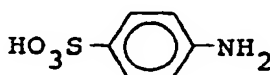
Example 9

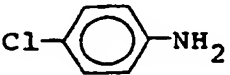
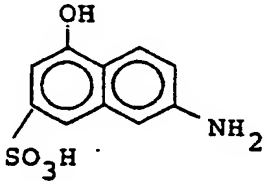
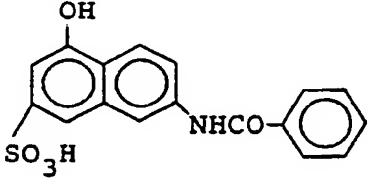
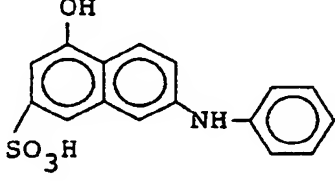
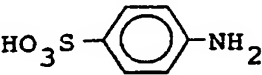
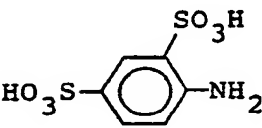
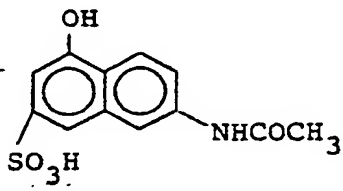
Example 1 was repeated, except that the aniline and 1-hydroxy-3-aminobenzene used in Example 1 were replaced with the compounds as shown in the second column of the following table (compound of formula (V)) and the compounds of the third column of the following table (compound of formula (VIII)), respectively, to synthesize the corresponding trisazo compounds. In the table, λ_{\max} denotes the values in an aqueous medium.


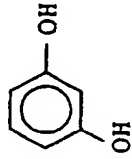
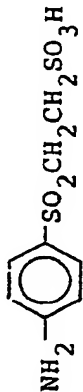
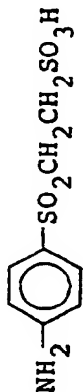
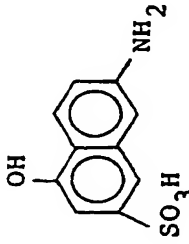
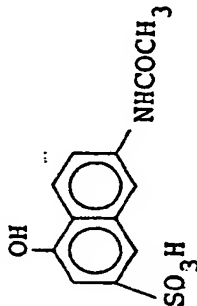
No.	Compound of formula (V)	Compound of formula (VIII)	λ_{\max} (nm)
37			610
38		"	625
39		"	610
40		"	610
41		"	605
42		"	610
43		"	620

No.	Compound of formula (V)	Compound of formula (VIII)	λ_{\max} (nm)
44			620
45		"	615
46		"	625
47			605
48	"		615
49	"		600

No.	Compound of formula (V)	Compound of formula (VIII)	λ_{max} (nm)
50			625
51			610
52		"	610
53		"	615
54		"	610
55		"	605
56		"	610
57		"	620

No.	Compound of formula (V)	Compound of formula (VIII)	λ_{\max} (nm)
58			620
59		"	610
60		"	625
61			600
62		"	600
63			600
64		"	600

No.	Compound of formula (V)	Compound of formula (VIII)	λ_{\max} (nm)
65			600
66	"		630
67	"		600
68		"	600
69			620

No.	Compound of formula (V)	Compound of formula (VIII)	λ_{\max} (nm)
70			600
71		"	610
72			610
73	"		610

Example 10

An ink was prepared from the following composition by the same procedure as in Example 8.

Trisazo compound of Example 9 (No. 42)	3.0 parts
Triethylene glycol	5.5 parts
Polyethylene glycol #200	10.0 parts
Dehydroacetic acid sodium salt	0.1 part
Deionized water	81.4 parts

The ink was sealed into a glass container and left standing at 20°C for 6 months or at 50°C for 2 weeks. After standing, the ink showed no deposition of crystalline matter, demonstrating a high stability of its quality.

Example 11

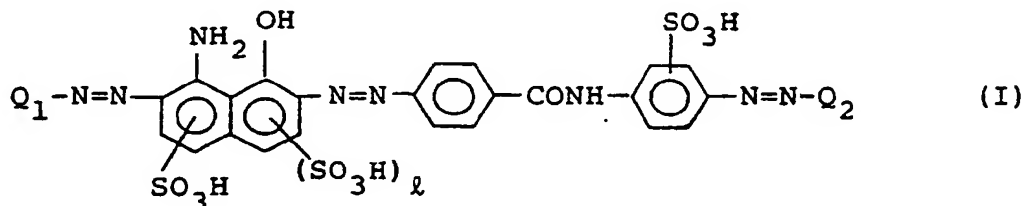
An ink was prepared from the following composition by the same procedure as in Example 8.

Trisazo compound of Example 9 (No. 62)	3.0 parts
Diethylene glycol	10.0 parts
Glycerine	3 parts
Dehydroacetic acid sodium salt	0.1 part
Deionized water	83.9 parts

Using the ink, an ink jet recording was continuously performed by the same procedure as in Example 8. As the result, no clogging of nozzle took place, and the result was stable.

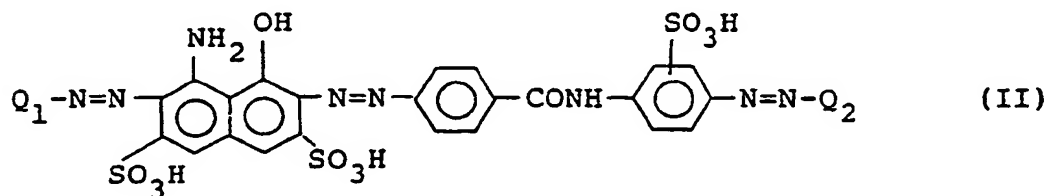
Claims

1. A trisazo compound represented by the following formula (I) in the free acid form:



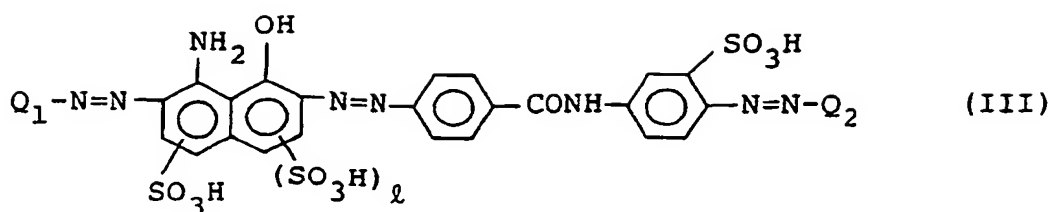
wherein Q₁ and Q₂ independently of one another are each an unsubstituted or substituted phenyl or naphthyl group and l represents 0 or 1.

2. The trisazo compound according to Claim 1 represented by the following formula (II) in the free acid form:



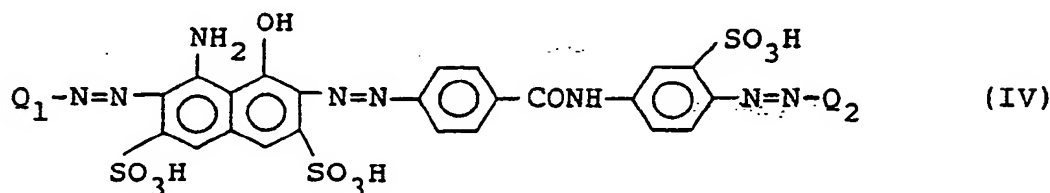
wherein Q₁ and Q₂ are as defined in Claim 1.

3. The trisazo compound according to Claim 1 represented by the following formula (III) in the free acid form:



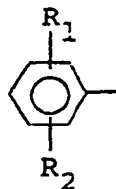
10 wherein l , Q_1 and Q_2 are as defined in Claim 1.

4. The trisazo compound according to Claim 1 represented by the following formula (IV) in the free acid form:



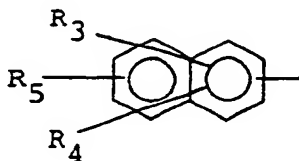
25 wherein Q_1 and Q_2 are as defined in Claim 1.

5. The trisazo compound according to any one of Claims 1 to 4, wherein Q_1 is a phenyl group represented by the following formula:



wherein R_1 and R_2 independently of one another are each hydrogen, a nitro, sulfo, sulfamoyl, alkyl, alkoxy, substituted or unsubstituted amino, carboxy or halogeno group.

6. The trisazo compound according to any one of Claims 1 to 4, wherein Q_1 is a naphthyl group represented by the following formula:

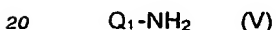


wherein R_3 , R_4 and R_5 independently of one another are each hydrogen, a hydroxy or sulfo group.

7. The trisazo compound according to any one of Claims 1 to 6, wherein Q_2 is a phenyl group substituted by 1 to 3 hydroxy group(s) and unsubstituted or substituted by a substituted or unsubstituted amino, sulfo, alkyl, alkoxy or carboxy group.
8. The trisazo compound according to any one of Claims 1 to 6, wherein Q_2 is a phenyl group substituted

by one or two substituted or unsubstituted amino group and unsubstituted or substituted by a hydroxy, sulfo, alkyl, alkoxy or carboxy group.

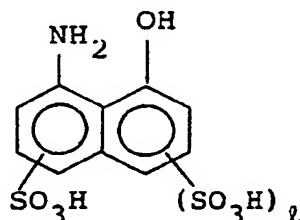
9. The trisazo compound according to any one of Claims 1 to 6, wherein Q_2 is a naphthyl group substituted by one or two hydroxy group(s) and unsubstituted or substituted by a substituted or unsubstituted amino or sulfo group.
10. The trisazo compound according to any one of Claims 1 to 6, wherein Q_2 is a naphthyl group substituted by one or two substituted or unsubstituted amino group(s) and unsubstituted or substituted by a hydroxy or sulfo group.
11. A process for dyeing or printing fiber or paper, which comprising using the trisazo compound according to any one of Claims 1 to 10.
12. An ink comprising the trisazo compound according to any one of Claims 1 to 10.
13. A process for producing the trisazo compound according to Claim 1, which is characterized in that a compound represented by the following formula (V):



wherein Q_1 is as defined in Claim 1, is diazotized in a conventional manner followed by coupling with a compound represented by the following formula (VI) in the free acid form:

25

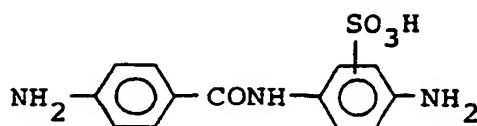
30



(VI)

- wherein l is as defined above, under acidic conditions, the product of the coupling reaction is coupled in an acidic or weakly alkaline aqueous medium with a tetrazo compound prepared by tetrazotizing in a conventional manner a compound represented by the following formula (VII):

40



(VII)

- and the disazo-diazo compound thus obtained is coupled with a compound represented by the following formula (VIII):



- wherein Q_2 is as defined in Claim 1.

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European Patent
Office

EUROPEAN SEARCH REPORT

Application Number

DOCUMENTS CONSIDERED TO BE RELEVANT			EP 91104877.5
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. CL.5)
X	<u>DE - A - 2 255 652</u> (AZIENDE COLORI NAZIONALI AFFINI ACNA) * Claims 10,21; page 1, lines 1-6; page 2, line 30 - page 3, line 19 *	1-5,7, 8,11, 13	C 09 B 35/46
X	<u>GB - A - 1 327 914</u> (BAYER AKTIENGESELLSCHAFT) * Page 1, line 10 - page 2, line 56 * & DE-B2-2 110 771 -----	1-5,7, 8,11, 13	
			TECHNICAL FIELDS SEARCHED (Int. CL.5)
			C 09 B
The present search report has been drawn up for all claims			
Place of search VIENNA		Date of completion of the search 05-07-1991	Examiner HAUSWIRTH
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ----- & : member of the same patent family, corresponding document			

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